ENVIRONMETAL TESTING OF THE PETITE AMATEUR NAVY SATELLITE (PANSAT)

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Any complex and expensive system requires testing to ensure adequate performance. Communications satellites require extensive testing for two additional reasons: they operate in an environment considerably different from that in which they were built and, after launch, they are inaccessible to routine maintenance and repair. The objectives of testing is not necessarily to duplicate the space environment but to approach it sufficiently so that any spacecraft that passes the tests will operate successfully in its designed space environment. The major features of the space environment that are difficult to simulate exactly are zero gravity, high vacuum, solar radiation, particle radiation and extreme temperatures. This document describes the environmental test program and the test results for the PANSAT program. PANSAT is the acronym for the Petite Amateur Navy Satellite, which is a small communications satellite under development by the Space Systems Academic Group at the Naval Postgraduate School. PANSAT subsystems were subjected to thermal vacuum and random vibration testing as part of the overall environmental test program. Satellite launch, as a Shuttle secondary payload via the Space Transportation System (STS) Small Self-contained Payload (SSCP) program, is planned for October 1998.

KEYWORDS: Environmental Testing, PANSAT, Spacecraft Testing

DoD KEY TECHNOLOGY AREA: Space Vehicles

CONVERT SUBMARINE COMMUNICATIONS USING EXTRA HIGH FREQUENCY (EHF) TRANSMISSIONS (U)

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This thesis quantifies the detectability of a transmitting U.S. nuclear submarine that is using EHF communications. This is done using a communications link analysis that is performed by circular equivalent vulnerability radius (CEVR) computer algorithm that displays its results in polar graph format. CEVRs for two different communication suites under alternative scenarios are calculated. Furthermore, by performing such an analysis onboard a submarine in precarious waters, the necessary real-time information for evaluating the risk of using such EHF communication transmissions would be available instantaneously.

KEYWORDS: Submarine, EHF, Communication

DoD KEY TECHNOLOGY AREA: Command, Control, and Communications

THERMAL ANALYSIS OF PANSAT
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The thermal control system of a spacecraft is designed to maintain all spacecraft components within their specified operating temperature limits throughout all phases of a spacecraft's mission. In order to verify and aid in such a design process, a thermal analysis of the system must be conducted. A thermal model of the spacecraft is used to simulate its behavior under given thermal environments and boundary conditions so that temperature predictions can be made.

The focus of this thesis is to develop and analyze thermal models of PANSAT which describe its thermal behavior while it is in orbit and also prior to its insertion in its orbit (while it is still in the shuttle). The results of these analyses will serve to help in the thermal design and performance of PANSAT. This thesis completes the thermal model prerequisites of the STS 95 space shuttle mission hitchhiker program for PANSAT. The emphasis of this thesis is to develop a model that will allow the prediction of the temperatures of all the electrical components including the temperature sensitive electrical components of PANSAT such as batteries over a complete orbit of the satellite.

KEYWORDS: Thermal Analysis, Spacecraft Thermal Control

DoD KEY TECHNOLOGY AREAS: Space Vehicles, Modeling and Simulation